ACCOUNT OF THE PHASMIDAE, WITH NOTES ON THE EGGS.

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With Plates VII—IX.

The specimens of this family of Orthoptera brought back by Dr Willey represent upwards of twenty species. Some of the species are represented only by individuals that are not full-grown, and I find that it is not desirable to deal with these, as we at present know but little of the post-embryonic development, so that it is difficult to determine what relations of colour, form and wing-development the young may bear to the adult. In the case of *Eurycantha horrida* I have identified the young with some probability of accuracy, and we have therefore figured some stages of the development. From what we find in the case of this species we may conclude that great changes in the external characters occur in the course of the development. Even when the difference between the sexes is very great in the adult state it is difficult if not impossible to distinguish the sexes in the young by external signs. Hence it is not at present desirable to describe and name new species from specimens that are not adult.

The species brought back from New Britain and Lifu in the adult state are six in number from Lifu, and eleven from New Britain. The Insect-fauna of these islands has not hitherto been the subject of any important study, and our knowledge of that of New Guinea is only small, so that it is scarcely a matter for surprise that a large proportion of the species—14 of the 17—appears to be unknown. Dr Willey was necessarily limited in his activity to a few spots on the coasts of the islands, and we may therefore conclude that many more species of these curious insects are existent in the two islands in question.

Under these circumstances it is not worth while to attempt any conclusions as to the geographical distribution. I may however remark that 53 species of Phasmidae are now known from Australia[1] and that they appear to have but little close

[1] Rainbow, *Rec. Austral. Mus. III.*, No. 2, 1897.

relation with those procured by Dr Willey; and it seems probable that a closer relationship with those of the islands to the West may be established. I may also remark that a great many of the Phasmidae recorded in the older works on entomology are said to come from Amboyna. I think this locality should not, without confirmation, be adopted as the real habitat of the species, as I doubt whether we can conclude more than that the ships bringing the specimens to Europe traded with that port. The uncertainty as to these old records will I fear delay any satisfactory conclusion as to the distribution of Malayan Phasmidae, at least until the Ceram and Amboyna fauna has been thoroughly investigated.

The young of Eurycantha. The adults of this genus are extremely remarkable; the number of spines on the body and the enormous size and curious armature of the hind legs of the male being especially conspicuous (Pl. VIII, Fig. 9). Dr Willey brought back a series of specimens in various pre-adult stages which I at first thought must represent more than one species, but which after comparison I believe to be stages in the growth, or instars[1], of *E. horrida.* Although probably no quite newly-hatched specimen is present, yet it is clear that most of the conspicuous characters of the species are acquired during the post-embryonic growth; almost the only resemblance between the youngest specimen and the adults are that both are broader and shorter than is usual in Phasmidae. The number of segments in the antennae is of great importance in the classification of the family; our series of *E. horrida* indicates a remarkable change in this feature during life. The youngest specimen we have has only nine segments on the antenna, whereas the adult has upwards of forty[2]. Nevertheless in the young the antennae are proportionally rather longer than in the adult, so that we have present the phenomenon of a great increase in number of segments, accompanied by an arrest of growth in comparison with other parts. Although our series is not sufficiently good to enable me to state with certainty the manner in which the change occurs, it would seem to be due to many of the segments of the young antenna dividing at once into a considerable number—about six—of smaller segments (Pl. VIII, Fig. 8).

The median segment of Phasmidae. It is commonly stated that the third thoracic segment in Phasmidae is formed by the union of the first abdominal segment with the metathorax. This view is stated by Brunner v. Wattenwyl[3], and is adopted by Heymons[4]. The adult insect so far as its structure goes does not exhibit positive evidence in support of this view so far as the sternum is concerned. On looking at the metasternum it is easy to imagine that one can detect in it a sufficiently complex structure to justify the view above alluded to; but on comparing it with the mesosternum exactly the same parts seem to be also present there (Fig. 10). As there can be no question of an abdominal sternite being added to the mesothorax, the view that one is added to the metathorax should be confirmed by observation of the development.

[1] For definition of this term refer to *Cambridge Nat. Hist.* v. p. 158.

[2] Only one antenna of the adults is intact, and this has 49 segments.

[3] Brunner v. Wattenwyl, *Morph. Bed. Segm. Orthopt.* Wien, 1876.

[4] Heymons, *SB. Ak.* Berlin, 1897, p. 367.

The ovipositor and female genital appendages. The genital structures in Phasmidae have been too much neglected by entomologists: they have been avoided for the purposes of distinction of species, and their morphology has scarcely been inaugurated. The structures in the male are remarkable for their simplicity, the intromittent organ of the male being apparently a crumpled sac with five or six more or less vaguely defined sclerites in it. In the female the genital appendages are of great importance for distinguishing the species. The two species, *Anchiale stolli* and *A. confusa*, much resemble one another externally and appear to have been confounded by entomologists for upwards of a century; yet the female genital appendages distinguish the two satisfactorily, and the distinction is placed beyond doubt by a comparison of the eggs of the two forms. The ovipositor in certain other forms of Orthoptera —Locustidae and Gryllidae—has been shown to be formed by six gonapophyses, which appear as separate parts in the early stages of the post-embryonic development and subsequently become intimately combined to form the long, projecting ovipositor. Of these six gonapophyses four, according to Dewitz[1], are appendages of the ninth segment and are really only a single pair secondarily divided; the other two are appendages of the eighth segment. In the female Phasmidae, six appendages are frequently present but they are never combined to form an organ for the deposition of the egg; they remain isolated finger-like processes (occasionally becoming so elongate as to be whip-like), and a part of their functions seems to be to hold the egg in the peculiar external uterus in which it remains till the female releases it, or till it is pushed out by the descent of another egg from the ovaries (Pl. IX, Fig. 16). These uncombined appendages appear to be homologous with the gonapophyses of the Locustidae as studied by Dewitz. One pair, the inferior, is separate and is anterior to the others in its attachment to the body. If we use Brunner's enumeration of the ventral sternites this pair of appendages belongs to the eighth segment, the ventral plate of which is prolonged to cover the genital appendages and to support the egg. The other two pairs are placed farther back and are merely prolongations of a large ninth abdominal sternite (Pl. IX, Fig. 25 c), as is well shown in the figure of the parts of an immature female of the genus Myronides (Fig. 26 b). The tenth sternite is very large, and is more or less deeply divided at the tip.

The male genitalia are very little known. Owing to the fact that so little material for study is available in the European fauna, nothing appears to have been published as to the organs of copulation. I have examined them in a very decayed male individual of *Anchiale confusa*, and find them to be remarkable from the existence of a very large sac which is covered by the pouch or receptacle formed by the ninth ventral plate; this membranous sac is formed by the ventral wall of the body, and when distended is found to consist of two imperfect pouches, portions of which are thickened and chitinised so as to form sclerites. Five or six of these indurated parts exist; they are quite asymmetric, and no two of them are at all similar; some of them are secondary projections from the wall of the sac, while others do not project at all. The hinder margin and the free angles of the tenth dorsal abdominal plate are also armed

[1] Dewitz, *Zeitschr. wiss. Zool.* xxv. 1875, p. 174.

with teeth and tubercles in various species, and these apparently afford good specific characters (Pl. IX, Figs. 18, 19).

The egg. A correct account of the structure of the eggs of two or three species of Phasmidae has been given by Leuckart[1]. As his account includes no reference to the incomplete egg or the mode of its growth the following observations may have some value. Phasmidae are insects of extreme interest; they appear to be the nearest living representatives of an Insect-fauna that was predominant in the carboniferous epoch; they exhibit an astonishing variety of grotesque forms, looking as if they were constructed of vegetable matter (so that some of them are called walking-leaves, others stick-insects) and they attain a size that is much above that of insects generally. They are exclusively vegetarian in diet, and are amongst the most inactive of insects. The climax of their peculiarities is found in the extremely perfect structure of their eggs and the resemblance of these eggs to seeds. The egg of a Phasmid has not only a general resemblance in size, shape, colour and external texture to a seed, but the anatomical characters of certain seeds are reproduced on the external surface, there being a hilar area, a hilar scar, and a capitulum corresponding to the micropylar caruncle of such seeds as those of the Castor-oil plant (*Ricinus communis*). The hilar area on the inner face of the capsule is, in shape, like the embryo of a plant (Pl. IX, Fig. 28). Moreover naturalists who have examined these eggs declare that the minute structures of this curious egg-capsule cannot be distinguished histologically from plant-structures. I think these resemblances, in the eggs I have examined, have no bionomic importance for the species. We have figured and described several of the eggs brought back by Dr Willey, and I have also added descriptions of two or three other interesting eggs obtained elsewhere.

In the examination of these eggs I have received much kind assistance from Dr Willey, and I think it may be of interest to state a few points we have ascertained as to their structure and the mode of their formation. I have examined the ovaries in *Eurycantha horrida* and in *Anchiale confusa* from specimens of these species brought back by Dr Willey in spirit and in a specimen of *Hermarchus pythonius* brought from Rotuma by Mr J. Stanley Gardiner. As these ovaries contain eggs in various stages of development it is possible to form an idea as to their mode of growth that may to some extent approximate to what actually occurs.

The capsule proper of the egg, or outer shell, is called chorion by Leuckart (who distinguishes an exochorion and an inner layer or endochorion); inside the chorion there is an inner membrane, the vitelline membrane or oolemn. The other important parts are the operculum, capitulum and micropylar area. All the parts of the egg are to the least detail formed in the ovarian tube. The operculum is present as a distinct part from a very early date, and so is the capitulum in those eggs in which it exists. When the egg is about half-grown the future exochorion forms merely a coat of quite soft matter which appears to appertain as much to the ovarian tube as to the egg; it can be removed with ease by a brush, and the egg is then found to consist of a yolk surrounded by two membranes similar in thickness. Of these the outer one subsequently becomes the inner wall of

[1] In Müller's *Arch. Anat. Physiol.* 1855, pp. 214—220.

the capsule. In this membranous stage the micropylar area is quite distinct on the endochorion and exhibits a very similar shape to that seen in the completed egg.

The exochorion subsequently becomes hard and very perfectly attached to the endochorion. It differs in the egg of every species I have examined, being in some cases very thick (Leuckart says 1/6 of a millimetre in *Cyphocrania violascens*), but in other species it is quite thin (Gigantophasma). This secondary product is very vegetable-like.

The vitelline membrane is free from the endochorion except at the micropyle, where the two are firmly connected; another striking peculiarity of this membrane is that it is considerably thicker under the operculum than it is elsewhere.

Capitulum. This peculiar structure, placed on the middle of the operculum, is present in the eggs of the majority of species of Phasmidae but is entirely absent from others. It differs in every species, but when present is always a well-developed structure, and there are, so far as I know no forms in which it is present in an atrophied or rudimentary state; it is always either well developed or entirely absent[1]. It consists of two parts, one of which is truly a part of the operculum; the capitulum itself is a less rigid body, superposed on the operculum and sometimes nearly concealing it (Pl. IX, Fig. 31). The part continuous with the operculum may form a stalk more or less elongate, and then projects to a greater or less extent into the soft body or capitulum proper, to which it forms a sort of core. The capitulum is present at an early stage of the formation of the egg, and if the half-grown egg of *Anchiale confusa* (Fig. 30) be looked at in the egg-tube it appears as if the capitulum is another less-grown egg attached to the larger egg. I think this will prove to be really the case and that the capitulum proper will be found to be the contents of another egg-chamber that have become subsidiary to the larger egg.

The species known to me in which the capitulum is entirely wanting are *Brachyrtacus celatus, Eurycantha horrida,* and *Hermarchus pythonius* (Figs. 32, 36, 41). I believe that the capitulum is also absent in the egg of *Acanthodyta spiniventris,* but this is not certain, as I speak only from my recollection of a single much damaged egg of which the operculum is now lost.

No function can be assigned to the capitulum in its formed state. It has, as was pointed out by Leuckart, no connection with the micropyle apparatus; it is not adapted to facilitate the admission of air to the egg, but must rather prevent such access. If it discharge any important function this is probably confined to a comparatively early period of the growth of the egg.

Operculum. This structure is present in all the known eggs of Phasmidae; it is a lid that fits very accurately to the truncate anterior extremity of the egg; its margin is surrounded by the margin of the capsule, and it is owing to the perfect fit between the two that the operculum retains its position. In the completed egg the operculum has no continuity with the capsule proper, neither have I been able to

[1] The egg of *Cyphocrania violascens* as figured by Leuckart, l. c. pl. x. figs. 19, 20, exhibits a small knob on the middle of the operculum. I think this is not a capitulum. The only mention of *Cyphocrania violascens* made by Westwood in his Catalogue of Phasmidae is as a synonym of *Acrophylla violascens;* this has been since referred by Stål to Tropidoderus, an insect now considered but distantly related to Cyphocrania. I do not know this insect or its egg.

demonstrate a continuity between the two parts at an earlier stage. The operculum it should be remembered is not seated on the chorion, but the latter is (apparently) quite absent from the anterior pole of the egg, where it is replaced functionally (as a covering and protecting body) by the operculum. In a comparatively early stage of the egg-growth, before there is any exochorion so that only the membranous endochorion is present, the operculum may be demonstrated as an independent structure placed on the yolk, and enclosing a smaller body of yolk. The egg itself may, at this stage, be entirely emptied of its yolk without affecting the opercular mass of yolk (Fig. 38). The exochorion of the operculum is formed subsequently, just as the exochorion of the capsule is formed subsequently, but there is no union between the two. The manner in which the operculum is formed is obscure; two methods may be suggested; 1, autotomy of the pole of the egg; 2, adhesion of the mass of matter from the adjacent nutrient chamber, to form as it were a very imperfect second egg. On this latter view the egg and operculum may be considered as the equivalent of an egg and a mass of matter added from another egg-chamber, and in that case when a capitulum is also present the egg would consist of egg-proper + opercular mass of nutrient matter + capitular mass of nutrient matter[1].

The fact that the vitelline membrane is thicker about the opercular area where the chorion is absent suggests that the missing part of the latter may possibly be added to the former, and thus account for the thickness. But on the other hand it is quite probable that the extra thickness may arise in course of the process of autotomy, if that be the method by which the operculum is formed.

The egg of a Phasmid, provided as it is with a separate and perfectly fitting operculum, is a very remarkable object. Hitherto it has appeared to me very difficult to imagine how it could have been produced by a gradual process of evolution. From the imperfect study I have now made I think it probable that the Phasmid egg will be found to consist of an egg proper and of one or two imperfect eggs mechanically coadapted by pressure arising from the enormous distention of the egg-tube. It appears to me reasonable to suppose that it might have been thus produced in a gradual manner in the course of time.

The observations on the spirit specimens may be thus summarised:

1. The ovarian tube contains nutrient matter divided segmentally into separate masses, and the lower part of the tube is constricted so as to form chambers in each of which there is a mass of nutrient matter.

2. The mass of matter in the lower chamber grows enormously so as to cause extreme distension of the egg-tube, and the whole mass of matter in the chamber (or very nearly the whole) is found to be covered with two membranes (endochorion and oolemn), the outer one of which is deficient at one pole of the egg where the (as yet membranous) operculum is situate.

3. The exochorion accumulates between the wall of the egg-tube and the outer

[1] I think it probable that some other curious forms of Insect-eggs (e.g. those of Cynipidae and some Hemiptera Heteroptera) may prove to be compound eggs of this nature; that is to say, formed by the combination of the more or less separate growths of more than one egg-chamber.

of the two egg-membranes and subsequently becomes perfectly adherent to the latter so that in the completed egg the two cannot be separated.

4. All the details of structure of the egg are completed in the chamber where the formation commenced.

I have arranged the genera in the order adopted by Brunner in his valuable "Revision du système des Orthoptères[1]."

ORTHOPTERA.

Family. Phasmidae.

Tribe. Lonchodides.

Genus. *Myronides.*

Myronides. Stål, Recensio Orthopterorum, III. Stockholm, 1875, p. 8.

This genus was established by Stål for two species from the Moluccas, and very little has since been added to it. In New Britain however the genus appears to be represented by numerous species. The chief character to distinguish it from Lonchodes is the longer median segment. Stål has not given any particulars as to the sexual distinctions, but I anticipate that the males and females are very different, so that direct observation will be required to match them. *M. binodis* is a very interesting form, as the peculiar nodes at the apex of the metanotum evidently represent wings in a rudimentary or vestigial condition (Pl. VII, Fig. 2).

SECT. I. Very Slender Insects [male only known].

(1) *Myronides filum*, n. sp. Pl. VII, Fig. 1.

♂. Perangustus, olivaceo-testaceus, antennis fuscis, mox ante apicem albidis; capite anterius tuberculis duobus distantibus, acuminatis armato, posterius subquadrituberculato; metanoto posterius utrinque vix gibboso, processu minuto instructo.

Operculo subgenitali abdominis haud convexo, apice rotundato medio leviter emarginato; lamina subanali profunde canaliculato, cercis liberis, sat elongatis; lamina supra-anali profunde emarginata; processu apicali interne tuberculis acutis circiter 16—24 instructo.

Long. corp. 76 mm.; antenn. 53 mm.; cap. post antenn. 3 mm.; pronoti 3 mm.; mesonoti 19 mm.; metanoti 6 mm.; segm. med. 4½ mm.; abdominis 39 mm.; femor. ant. 24 mm.

Var. fusco-nigricans.

Loc. New Britain.

There are no tuberosities or asperities on the surface of the body, and the two teeth at the apex of each femur are very minute. The first joint of the antenna is straight-sided and rather narrow.

[1] *Ann. Mus. Genova*, XXIII. 1892—3.

If I am right in considering the two dark specimens as the same species, it is possible that this insect is dimorphic in colour; there are at any rate no intermediates in our small series.

(2) *Myronides binodis*, n. sp. Pl. VII, Fig. 2.

♂. Perangustus, testaceus, antennis ad apicem pallidioribus; capite anterius mutico, vertice obsolete quadrituberculato; metanoto posterius utrinque gibboso.

Operculo subgenitali convexo, medio prominulo, apice late emarginato.

Although at first sight similar to *M. filum* this species is very easily distinguished by the absence of processes on the front of the head, by the binodose metathorax, by the different proportions of the metanotum and median segment, and the prominent male operculum. The curious short sacs attached to the metathoracic gibbosities clearly represent the wings, though they have the texture of the integument in general.

Long. corp. 76 mm.; antenn. 53 mm.; cap. post antenn. 3 mm.; pronoti vix 3 mm.; mesonoti 19 mm.; metanoti 8 mm.; segm. med. $4\frac{1}{4}$ mm.; abdominis 38 mm.; fem. ant. 23 mm.

Loc. New Britain.

SECT. II. Broader Insects [female only known].

(3) *Myronides bituber*, n. sp.

♀. Corpore granuloso, fusco-testaceo, pedibus testaceis fusco-variegatis, antennarum apice albido; capite processubus duobus acuminatis, magnis armato; abdomine carinato, carina anterius obsoletescente, segmento sexto medio bituberoso.

Long. corp. 120 mm.; antenn. 60 mm.; capitis (pone antenn. acetab.) 5 mm.; pronoti 5 mm.; mesonoti 26 mm.; metanoti $9\frac{1}{2}$ mm.; segm. med. $5\frac{1}{2}$ mm.; abdom. 59 mm.

Loc. New Britain. One specimen.

Although at first similar to the other species here described this may be readily distinguished by the pair of peculiar tuberosities on the dorsum of the sixth abdominal segment.

Egg (Pl. IX, Fig. 33): 3 mm. long; capsule covered with numerous large pores, and with a scanty coarse but slightly elevated reticulation; micropylar area not extending to the operculum, and moderately distant from the opposite pole, rather narrow; micropylar scar very obscure. Operculum bearing a black sessile capitulum, and surrounding this a slightly elevated ring. Described from eggs deposited by the female in New Britain while in Dr Willey's possession.

(4) *Myronides simplex*, n. sp.

♀. Angustus, cylindricus testaceo-griseus, antennis pedibusque subvariegatis, illis ad apicem albidis, apice ipso minute fusco, articulo primo ovale; capite superne processubus duobus distantibus, mediocriter elevatis, acuminatis; tarsorum anticorum articulo primo superne alte carinato; abdomine segmento sexto dorsali in medio

utrinque tuberculo vix perspicuo armato: femoribus subtus versus apicem minute bidentatis.

Long. corporis 104 mm.; lat. corp. vix 5 mm. Long. antenn. 60 mm.; capitis post antenn. 5 mm.: pronoti 4½ mm.; meson. 25 mm.; metan. 8 mm.; segment. med. 6½ mm.; abdominis 55 mm.; femor. ant. 24 mm.

Loc. New Britain.

Readily distinguished from *M. bituber*, by the smaller processes on the head, and by the tuberosities on the abdomen being almost entirely absent. The male is unknown. The surface is uneven, the inequalities forming on the prothorax indefinite tubercles.

(5) *Myronides sordidus*, n. sp.

♀. Robustus, griseo-testaceus, antennis mox ante apicem albidis, corpore superne sparsim irregulariter granuloso; capite anterius processubus duobus distantibus sat elongatis, acuminatis, apicibus versus antennas directis; antennarum articulo basale sat lato, margine interno curvato; tibiis anterioribus intus acute carinatis, carina versus basin altiore; lamina supra-anali acuminata, carinata.

Long. corp. 104 mm.; antenn. 62 mm.; tib. ant. 27 mm.; cap. post antenn. 4 mm.; pronot. 4½ mm.; mesonoti 27 mm.; met. 10 mm.; segm. med. 5½ mm.; abdom. 53 mm.

Loc. New Britain.

Only one individual of this species was obtained. It is closely allied to the typical species of the genus—*M. pfeifferi*—but is smaller, and the legs are somewhat differently formed. The two teeth on each femur are minute.

Egg (Pl. IX, Fig. 34): an egg taken from the ovipositor of the specimen after preservation for a year or more in spirit, much resembles that of *M. bituber* but with strongly-marked distinctions; the texture of the capsule is different; the capitulum is not sessile, but is elevated on a short stalk, and the ring surrounding it is strongly elevated and irregularly serrate (Fig. 34 *a*). The micropylar scar is linear and the micropylar orifice is exposed and surrounded only by a small obscure ring.

(6) *Myronides ramulus*, n. sp. Pl. VII, Fig. 3.

♀. Sordide testaceus, irregulariter fusco-subvittatus, parce, obsolete granuloso; capite mutico: abdomino segmento decimo margine posteriore utrinque biacuminato; lamina supra-anali acuminata; operculo compresso-carinato; appendices inferiores et mediani aequilonges, elongati.

Long. corp. 106 mm.; antenn. 52 mm.; capitis post antenn. 4½ mm.; pronoti 4 mm.; mesonoti 26 mm.; metan. 10½ mm.; segment. med. 5 mm.; abdominis 56 mm.

Var. fusco-subvariegato, haud discrete vittato.

Loc. New Britain.

In this species the granulation of the surface is more distinct on the metasternum. As it and *M. binodis* both have the head unarmed it is possible they may be the sexes of one species. There is no trace of the rudimentary wing-sacs in *M. ramulus*.

In addition to the type specimen and the variety, Dr Willey found a nymph evidently near the last ecdysis, being of about the full size. The stripes are very distinct in it.

GENUS. *Brachyrtacus*, n. g.

♀. Antennae elongatae, multiarticulatae, corpus inerme apterum, pedes simplices, segmentum medianum vix discretum, sat breve, metanoto multo brevius; abdomen in processu subacuminatum prolongatum; cerci minuti.

♂. Incog.

This genus very much resembles Hyrtacus Stål, but has a shorter head and a longer median segment. Few Phasmids are so destitute of conspicuous characters. The elongate, terminal, ovipositor exists in but few genera and will aid those who have not access to an exponent of Hyrtacus in recognising this form.

In addition to the median segment there are only eight dorsal abdominal plates and the elongate terminal process. The latter structure is doubtless formed by the fusion of the ninth plate and the lamina supra-analis; in Eurycantha the two parts remain distinct.

The genus Hyrtacus is Australian, and only two species are referred to it as yet. Stål made the elongate head of *H. tuberculatus* one of the chief characters of the genus. *B. celatus* has a head of only the length of ordinary Lonchodides, and I have therefore been obliged to treat the New Britain insect as a distinct genus.

(7) *Brachyrtacus celatus*, n. sp. Pl. VII, Fig. 4.

♀. Pallide fuscus, lividus, inornatus; subtiliter punctatus; capite canaliculato.

Long. corp. 70 mm.; antenn. 47 mm.; capitis post antenn. 2 mm.; pronoti $2\frac{3}{4}$ mm.; mesonoti $16\frac{1}{2}$ mm.; metan. $6\frac{1}{2}$ mm.; segm. med. 2 mm.; abdom. 40 mm. (lam. supra-analis cumque abdominis segm. ult. 9 mm.); femor. ant. 17 mm.

LOC. New Britain.

The three specimens found by Dr Willey are extremely similar. An immature nymph of the male sex renders it probable that the male will be found to closely resemble the female in size and form. The colour of this nymph is pale green.

Egg (Pl. IX, Fig. 32). The egg of this species is remarkable for its long slender form; at first sight it might be supposed to be the egg of a Locustid, but the operculum is quite definite and the micropylar area is well-marked; there is no capitulum. We have only one specimen, it has been damaged by fracture just across the micropylar scar so that the details of the structure are obscured.

TRIBE. Clitumnides.

GENUS. *Eurycantha*.

Eurycantha. Boisduval, Voy. de l'Astrolabe, Zool. Ent. p. 647.

The remarkable insects composing this genus appear to be peculiar to New Guinea and the neighbouring islands.

(8) *Eurycantha horrida.* Pl. VIII, Fig. 9.

Eurycantha horrida. Boisd., Voy. de l'Astrolabe, Zool. pl. 10, f. 2. Westwood, Cat. Phasm. p. 63.

A fine series of this insect was procured by Dr Willey in New Britain. In the adult state it varies but little; the antennae are usually more or less deficient as to their terminal joints; the proper contingent appears to be about 48.

Several specimens that I believe to be young of this species were procured (Figs. 7, 8); if so, it appears to be variable in colour in early life; most of these young are similar in colour to the adults except that they are not quite so dark; two specimens are of a pallid stone-grey colour, maculated with darker fuscous marks. It is possible, however, that one or both of these specimens may be of another species; Kaup has described a second Eurycantha as occurring in New Guinea. The young specimens are in various stages of development, and they at any rate show that the armature of spines on the body and legs is developed gradually during the process of growth. The number of joints of the antennae is apparently the same throughout the later period of development, though the distinctness of their segmentation is less marked in the young, and in the very young there is a major segmentation into 7 or 8 joints, without any distinct segmentation of either of these into a larger number of joints (Fig. 7 *a*). The genital appendages of the female are also developed gradually, so that it is very difficult to distinguish the two sexes in the young.

Egg (Pl. IX, Fig. 41). Dr Willey kept specimens of this species alive and was able to observe that the eggs are dropped one at a time. On August 11th he noticed an egg in the ovipositor which was still in that position next day; on the 13th he found one egg was deposited: on Aug. 14th the same female had another egg ready for deposition, and this was still *in situ* the following day but was deposited on the 16th, and on the same day another egg was in the ovipositor and was deposited on the 17th: on the 18th the same specimen laid three eggs, and another on the 19th. The egg is large, 8 mm. long. It is of a grey colour, irregularly mottled with black and the whole surface of the capsule is covered with fine raised lines. The hilar area is broad and short, oval, the scar is broad and widely open in front. There is no trace of any capitulum on the operculum but the central area is slightly pinched together, and has a slightly different texture when highly magnified (Figs. 41 *a*, 41 *b*).

Tribe. Acrophyllides.

Genus. *Acanthodyta*, n. g.

Antennae breves, circiter 20-articulatae; thorax et abdomen spinosa; pedes mediocriter elongati, femoribus omnibus fere inermibus, marginibus superioribus et inferioribus omnium tantum minutissime spinulosis; tegmina nulla; alae utriusque sexus brevissimae. Segmentum mediauum elongatum, metathorace longius. Maris cerci robusti. Feminae cerci minuti haud exserti, lamina supra-analis valde prolongata; segmentum dorsale ultimum sub-prolongatum.

This genus, tested by Brunner's Tables[1], runs down to Acrophyllidae, Platycraniae, and may be placed next Arrhidaeus.

[1] "Revision du système des Orthoptères," *op. cit.*

(9) *Acanthodyta spiniventris*, n. sp. Pl. VIII, Fig. 11 ♀.

Testacea, vel fusco-testacea; alis minimis, parte posteriore sanguineo-tincta; corpore lateraliter et superne spinoso; pedibus fere inermibus; capitis fronte bituberculata.

♂. Cerci elongati, intus curvati.

Long. corp. 55 mm.; antenn. 17 mm.

♀. Lamina supra-anali ultra anum longe producta, acuminata; appendices antero-inferiores elongati, lineares, duri, ultra cercos extensi, apicem abdominis ventris attingentes; operculum subgenitale elongatum, apicem versus attenuatum, apice obtuso, lamina supra-anali brevius; appendices mediani, elongati sublineares, cercos attingentes; appendices superiores nulli. Cerci breves sat lati, ad apices obtuse attenuati, margine externo ciliato-setoso.

Long. corp. 86 mm.; antenn. 20 mm.; capit. post antenn. 5 mm.; pronoti 5 mm.; mesonot. 18 mm.; metanot. (partis alas ferentis) 4 mm.; segm. med. (cumque parte posteriore metanoti haud discreta) 5½ mm.; abdominis 50 mm.; femor. ant. 29 mm.; tibia. ant. 38 mm.

Loc. Lifu.

Only one pair of the mature Insect was found. The male is much darker than the female in colour. A female nymph well advanced in growth has the spines of the upper surface represented only by minute acute tubercles.

Egg (Pl. IX, Fig. 40): an egg of this species was found in the ovipositor, but was damaged by extraction so that it has lost the operculum. The micropylar area extends the whole length of the egg and is at the farther extremity very distinctly divided into two processes that probably correspond with the attachment of membrane on the inner surface of the capsule.

GENUS. *Graeffea.*

Graeffea. Stål, Recensio Orthopterorum, III. 1875, p. 40.

The Insects of this genus appear to be peculiar to the Polynesian islands, where they are said to be sometimes very injurious by consuming the foliage of the food-plants of the human inhabitants.

(10) *Graeffea lifuensis*, n. sp. Pl. IX, Fig. 21.

♀. Testacea; prothorace subtiliter, irregulariter granuloso; alis brevibus, parte membranacea sanguinea.

G. coccophagae peraffinis; cercis longioribus, lamina supra-anali medio longiore, acuminata; segmento mediano magis elongato.

Long. corp. 118 mm.; antenn. 23 mm.; fem. anter. 34 mm.; cap. post antenn. 6 mm.; pronoti 6 mm.; meson. 20 mm.; metan. 5½ mm.; segm. med. 6 mm.; abdom. 63 mm.; cerc. 7½ mm.; tegm. 7 mm.; alar. 14 mm.

The genital operculum is not convex, it is pointed and elongate, extending a little beyond the point of the lamina supra-analis. The superior and inferior genital appendages extend backwards to just the same point; the inferior are slender and filiform; the median and superior are short, as they merely form the divided extremities of a broad process; the median pair does not extend quite so far back as the lateral pairs.

Loc. Lifu: two specimens.

I have not seen the egg, but judging from the shape of the uterus I suppose it will prove to be elongate and slender. The uterus in this species is very different from what it is in Anchiale.

Only one or two species of this genus have been described, but judging from specimens in the British Museum there are several closely allied species, or forms, in the Polynesian islands. *G. coccophaga* was found in Rotuma in both sexes by Mr Stanley Gardiner, it is less elongate than *G. lifuensis* and has shorter legs. *G. coccophaga* is the species that is reputed to be at times very injurious, by consuming the foliage and soft parts of trees from the produce of which the human natives draw part of their sustenance.

GENUS. *Gigantophasma*, n. g.

Antennae 30 articulatae, maris femoribus paulo longiores, feminae femoribus aequales. Maris, alae magnae; femina omnino aptera. Cerci maris sat magni, laminati, feminae maximi. Ocelli nulli. Segmentum medianum metanoto brevius. feminae segmento secundo abdominali toto, maris segmenti secundi dimidio, aequale. Maris metanotum in partes duas divisum. Segmenta abdominalia feminae lateraliter plus minusve lobo-dilatata. Pedes multidentati. Fem. operculum subgenitale ultra apicem abdominis extensum, lamina supra-analis nulla.

The position of this genus is uncertain. According to Brunner's tables, the male would come into Acrophyllidae (supposing that we consider the posterior division of the metanotum to be part of the median segment) and might be placed near Monandroptera. The female on the other hand would come into Clitumnidae near Medaura. The very large cerci induce me to place this curious form in Acrophyllidae, near Monandroptera, a genus about which little appears to be known. The female has a considerable general resemblance to *Hermarchus pythonius*, though differing greatly by the abnormal development of the cerci.

The male is of interest from the extremely definite division of the metanotum into two parts. The posterior of these is less distinct in some other forms, and in them is apparently counted as part of the median segment. Gigantophasma apparently shows clearly that the metanotum really consists of two parts. This is seen less clearly in various other Phasmidae.

(11) *Gigantophasma bicolor*, n. sp. Pl. VII, Fig. 6 ♀.

Fem. Fusco-viridis, superne a pronoti margine posteriore usque ad segmentum abdominis sextum viridis, segmentis late fusco-marginatis; abdominis segmentis 2—7 lateraliter plus minusve lobo-dilatatis, segmentis 8—10 parvis; femoribus posterioribus superne ad apicem lamina elevata ad apicem spinigera; tibiis rude spinosis.

Long. corp. ind. minor. 163 mm.; antenn. 43 mm.; cap. post antenn. 9 mm.; pronot. 8 mm.; mesonot. 30 mm.; metanot. 17 mm.; segm. med. 9 mm.; abdominis 88 mm.; cerci 9 mm.; femor. ant. 42 mm.

Lat. segm. med. 12 mm.; abdom. segm. 16 mm.; cerc. 6 mm.

Long. corp. ind. major. 180 mm.

Mas. Gracilis; testaceo-viridis, subfuscescens; abdomine segmentis 5 et 6, tenuiter lobo-dilatatis, lobis fuscescentibus; femoribus posterioribus spinis 5, elongatis, armatis.

Long. corp. 95 mm.; antenn. ultra 40 mm.; cap. post antenn. $4\frac{1}{4}$ mm.; pronot. 4 mm.; mesonot. 15 mm.; metanoti partis alas ferentis $5\frac{3}{4}$ mm.; pars poster. 4 mm. segm. med. 4 mm.; abdom. seg. secundi $9\frac{1}{2}$ mm.; abdom. 58 mm.; cerc. $4\frac{1}{2}$ mm.

Var. *depictus*. This species varies a good deal in colouration, and also in the form of the cerci, the length of the legs, and of the ovipositor, and even in the shape of the abdominal segments and their lateral expansions. In one individual the fuscous marks bear at the back of each thoracic and abdominal segment a pallid mark forming an inner margin to the fuscous marks; although I do not think this is a distinct species it may be well to give it a name.

Loc. Lifu.

Egg (Pl. IX, Fig. 35). The egg of *G. bicolor* is small in proportion to the size of the insect, being scarcely $3\frac{3}{4}$ mill. long including the capitulum. It is less remarkable in structure than usual with Phasmid eggs. The surface of the capsule is densely and finely rugose. The lines limiting the micropylar area are not elevated, the micropylar scar is strongly elevated, forming a slightly curved transverse line, concealing the micropylar orifice. The capitulum is large without any trace of a stalk, and bearing a deep pit at the top. The shell of the egg is thin.

The egg in this species is variable like the insect itself: and it is possible that these forms may be "incipient species," but the material at my disposal is too small to allow me to form any decided opinion.

(12) *Gigantophasma pallipes*, n. sp.

Fem. Viridi-testacea, antennis pedibusque pallidis; abdominis segmentis 2—7 lateraliter plus minusve lobo-dilatatis, segmentis 8—10 parvis: femoribus intermediis et posterioribus, tibiis posterioribus ad apicem, absque lamina elevata.

Long. corp. (cum ovipos.) 187 mm.; (cetera fere ut in *G. bicolore*).

Loc. Lifu: a single specimen.

Independently of the pale colour—which is perhaps of little importance as a specific character—this Insect differs from all the specimens of *G. bicolor* by the absence of the elevated laminae on the middle and posterior femora and tibiae, and by the longer basal joint of the posterior tarsi, the upper margin of which is not curvate. The ovipositor extends 12 mm. beyond the tip of the abdomen.

Dr Willey brought back a specimen which is probably the male of this species (Pl. VII, Fig. 5), as it has pallid legs and antennae: the small lateral lobes of the abdomen possess a metallic, golden, reflection, and the cerci are shorter and broader than they are in the male of *G. bicolor*, and the spines on the hind femora are more numerous (Pl. IX, Fig. 22).

[*Hermarchus pythonius*. Although this species was not obtained by Dr Willey, we figure the egg (Fig. 36) taken from the ovaries of a specimen brought by Mr Stanley Gardiner from the island of Rotuma. The sculpture of the capsule is remarkably coarse, and the operculum, which is destitute of a capitulum, has a very deep circular

depression round the central part. We also figure an egg-tube (Fig. 37) with the egg still incomplete though of large size: and the opercular pole of a less grown egg, in which the operculum can be distinguished with a mass of nutrient matter situate within it (Fig. 38).]

[*Cyphocrania hanitschi*, n. n. Dr Willey brought back eggs of a Phasmid which has been exhibited in a live state in the gardens and Museum at Singapore, as described in the report of Dr R. Hanitsch for 1897.

The Insect (probably undescribed) is allied to *C. goliath* Gray. and as the egg is remarkable for the large size of the capitulum we figure it, Pl. IX, Fig. 39. The micropyle is exposed and is readily perceived in consequence of the very slight elevation of the ring of the scar, Fig. 39 *a*.]

GENUS. *Anchiale*.

Anchiale. Stål, Recensio Orthopterorum, III. 1875, p. 36.

Only one species of this genus appears at present to have been recognised, but it is very closely allied to the Malaysian Cyphocrania.

(13) *Anchiale stolli*, n. n. Pl. IX, Fig. 16.

Elongata: mesothorace discrete tuberculato, tuberculis subacutis; cercis latis: alis fusco-brunneis, hyalino-maculatis.

Mas.; antennis elongatis (articulis 1—22 = 54 mm.); longe hirsutis, ocellis valde prominulis fere conjunctis; cercis ovalibus, angulo apicale per-obtuso; lamina supra-analis abrupte tectiformis, margine interno acute quinque dentato.

Long. corp. 106 mm.; pronot. 4½ mm.; mesonoti 16 mm.; metanoti 8½ mm.: segm. med. 5½ mm.; abdominis 68 mm.; cerci 4½ mm.; lat. 2½ mm.; tegm. long. 13 mm.: alae 60 mm.

Fem.; antennis brevibus (articulis 1—22 = 32 mm.), breviter pubescentibus; ocellis subobsoletis; cercis elongato-ovalibus, acuminatis; operculo obtuse acuminato ad apicem abdominis extenso, medio carinato; processubus genitalibus inferioribus elongatis, apicem laminae subanalis fere attingentibus; proc. medianis brevioribus, paulo ultra proc. superiores extensis; his latis, liberis, acuminatis.

Long. corp. 170 mm.; pronoti 9 mm.; mesonoti 25 mm.; metanoti 10 mm.; segm. med. 10 mm.; abdom. 100 mm.; cerci 6½ mm.; lat. 3 mm.; tegm. 30 mm.; alae 70 mm.

Loc. New Britain.

The species in the female sex is apparently dimorphic in colour, the tints being either those of young and green, or old and withered vegetation. I have only seen one individual of the male sex: it has six small teeth on the inflexed terminal portion of the last dorsal segment (Pl. IX, Fig. 19).

Egg (Fig. 27): 4½ mm. long, 3½ broad, of a slaty-grey colour, indefinitely mottled with paler grey, surface shining, a little irregular or uneven, not sculptured or porous. Micropylar area elongate, raised; micropylar scar large, almost horse-shoe shaped; capitulum pallid, rather small, placed on a short black base; operculum without sculpture, the middle part—in which the capitular stalk is placed—somewhat depressed after the fashion of a dish or plate.

This egg is remarkable on account of the absence of sculpture on the capsule; the stalk of the capitulum forms a conical process the terminal part of which projects into the pallid membranaceous top of the capitulum.

It is possible that Stoll's[1] figure of the male[2] and female[3] of "Le spectre à aîles tachetécs" may have been taken from this species. The locality he gives was, however, "Amboina," and the form of the cerci does not agree. His figure has been universally applied by synonymists to the following species, viz. *A. confusa.*

(14) *Anchiale confusa*, n. n. Pl. IX, Fig. 17.

Cyphocrania maculata. Westwood, Cat. Orthopt. Phasmidae, p. 111 [nec Serville].

Fem. Elongata; mesothorace obsolete parceque granoso; cercis latis, alis fusco-brunneis, hyalino-maculatis.

Antennis brevibus, parce pubescentibus, ocellis subobsoletis; cercis brevibus, rotundatis; operculo minus obtuso, paulo ultra abdominis apicem extenso, medio carinato; processubus genitalibus inferioribus elongatis apicem laminae sub-analis attingentibus; processubus medianis inferioribus fere aequalibus; proc. superioribus elongatis, gracilibus.

Long. corp. 156 mm.; pronoti 7½ mm.; mesonoti 27 mm.; metanoti 8 mm.; segm. med. 9 mm.; abdom. 94 mm.; cerci 4 mm.; lat. 2¼ mm.; tegm. 27 mm.; alae 62 mm.

Loc. New Britain.

This species was met with by Dr Willey in two examples of the female sex, and an extremely decayed male. It is readily distinguished from *A. stolli* by the almost smooth thorax, and the more elongate, middle and superior (lateral) genital filaments; as well as by the rounded apices of the cerci. The male has three large, instead of six small, teeth on the inflexed margin of the last dorsal plate of the body (Pl. IX, Fig. 18).

This species is the *Cyphocrania maculata* of Westwood, according to specimens in the British Museum. Westwood was, however, in error in considering this to be the species designated by Stoll, Serville and others as *C. maculata.* Stoll did not at first give his species any name, but Serville and others took his figure as the type of their species, and if their assignment of a name on such grounds be attended to at all we must give a new name to Westwood's Insect. The name *Phasma necydaloides,* subsequently assigned by Stoll to his species, was then pre-occupied by Linnaeus.

The figure of *Platycrana necydaloides* in the *Voyage au Pôle sud* may possibly have been taken from a specimen of this or an allied species. It exhibits the thorax as entirely smooth. It is from the island of Warou.

Egg (Pl. IX, Fig. 29): 4½ mm. long, 3½ broad; slaty-black, densely covered with rugose sculpture. Micropylar area, narrow and compressed so as to be strongly raised, and to form a sort of band extending from the operculum to near the other pole of the egg: the micropylar scar coarse but not very distinct on account of the coarse, uneven, neighbouring sculpture, almost V-shaped. Capitulum small, pallid, placed on a short black stalk, obconic so as to be with the stalk almost funnel-shaped.

[1] Stoll (Caspar), Afbeeldingen Spooken, etc. Amsterdam, 1787.
[2] Pl. IV, Fig. 11. [3] Pl. III, Fig. 8.

Numerous eggs of *A. stolli* and *A. confusa* were deposited by specimens kept alive by Dr Willey. He noticed that when an egg is deposited another one immediately replaces it in the ovipositorial uterus. The generic resemblances between the eggs of *A. stolli* and *A. confusa* is very evident, but the specific distinctions are so strongly marked as to support the suggestion of Kaup that the eggs may possibly afford the best way of distinguishing closely-allied species of Phasmidae.

Tribe. Phasmides.

Genus. *Cacomorpha*, n. g.

Corpus parum elongatum, maris alatum, feminae omnino apterum; pedibus parum elongatis, femoribus dilatatis fimbriatis, tibiis marginibus undulatis, tarsis margine interno sulcato. Antennis elongatis, 20-articulatis, articulis discretis; metathorace utrinque lobo singulo fimbriato, pendente (Fig. 23); metanoto breve; segmento mediano illo duplo longiore (in femina haud discreto); corpore subtus membranaceo, laevigato, metanoto utrinque loba libera ciliata; lamina subgenitali in utroque sexu breve, haud prominula.

This genus is evidently allied to Cotylosoma (C. Waterhouse, *Ann. Nat. Hist.* xv. 1895, p. 498) but that genus has tegmina and short wings in the female, and the side of the breast has five free lobes. Cacomorpha should no doubt be placed in Brunner's group Prisopi, but it is scarcely possible to assign a definite position in the present system of Phasmidae to these curious Insects. The antennae are much longer than the femora but possess only 20 joints. The tibiae are smooth beneath but have no apical area, though the Prisopi are placed by Brunner in the tribe Phasmidae, which is characterised by the possession of an apical area to the tibiae, and by being winged in both sexes. Prisopus is an American genus and has a short mesothorax, thus departing strongly from Cacomorpha. The sexual characters are peculiar, there being no genital appendages covered by the short, flat lamina subgenitalis of the female.

(15) *Cacomorpha aberrans*, n. sp. Pl. VIII, Fig. 12 ♀.

Corpore testaceo, fusco-variegato; subtus pallido, laevigato membranaceo; capite brevi inerme; mesonoto granulato; cercis sat elongatis sublinearis.

♂. Tegmina parva, alae magnae; abdomine sublineari, laevigato, tantum ad apicem rugoso.

Long. corp. 38 mm.; antenn. 20 mm.; capitis post antenn. 2 mm.; pronoti 2½ mm.; mesonoti 5½ mm.; metanoti 2¼ mm.; segm. med. 5 mm.; abdominis 20 mm.; femor. ant. 9 mm.

♀. Aptera, supra rugosa, abdomine lato.

Long. corp. 50 mm.; metanoti 2 mm.; segm. med. 5 mm.; abdominis 26 mm.; lat. abdominis 7 mm.

In the male the lamina supra-analis is not visible, in the female it forms a minute bifid process. The cerci are similar in the two sexes.

Loc. Lifu: one male, two females.

The specimens were brought to Dr Willey by natives, the species is certainly not aquatic, there being no water on Lifu except in wells. In all probability it lives closely appressed to the stems of bushes. Wood-Mason's idea that the lobes in Cotylosoma are tracheal gills seems to me to have no foundation whatever.

TRIBE. Phylliides.

GENUS. *Phyllium auct.*

Only two genera are recognised in this tribe, Phyllium and Chitoniscus Stål, the latter being found in the Fiji islands. Dr Willey met with a species in Lifu which is exactly similar in appearance to *Chitoniscus feejeeanus*, but has the nervuration of Phyllium.

(16) *Phyllium brachysoma*, n. sp. Pl. VIII, Fig. 13.

♀. Minor, viride; pedibus brevibus, femoribus parum dilatatis, anterioribus lobo interno parvo, intus rotundato, margine interno obscure tridenticulato.

Long. corp. 52 mm.; tegm. long. 32, lat. 12½ mm.; long. femor. ant. 9½ mm.; lobo interno long. 6, lat. 3 mm.

LOC. Lifu. Two female specimens.

This is the smallest Insect of the genus; it is in appearance allied to *Chitoniscus feejeeanus*, but is readily distinguished by the shorter form, and especially by the shorter legs, the front femora being in *C. feejeeanum* 11½ mm. long. There are only three distinct teeth on the lobe of the front femur, but near the apex, there are two other very minute denticles; there are no serrations between the denticles. The most marked difference between the two species is however to be found in the nervuration. In *C. feejeeanus* (Pl. VIII, Fig. 14) the radial vein diverges from the ulnar vein quite at the base, while in *P. brachysoma* the two run parallel and contiguous. As *C. feejeeanum* is known only by the very brief description given by Westwood (Proc. Ent. Soc. Lond. ser. 3, II. 1864, p. 17), we have figured the tegmen. *P. brachysoma* agrees fairly well with *P. scythe* in the nervuration, but it has the mesothorax short as in Chitoniscus, so that if Stål's genera are considered valid, *P. brachysoma* should form a third.

(17) *Phyllium*, sp. Pl. VIII, Fig. 15.

Dr Willey brought a young nymph from New Britain which probably represents a new species of this interesting tribe, it being destitute of a lobe at the back of the front femur. *P.* (*Chitoniscus*) *feejeeanus* has been recorded as living in New Britain[1], but I cannot identify this young individual as belonging to that species.

The sexes of Phyllium are in the adult state extremely different in form and in the condition of the wings, which are quite atrophied in the female but well developed in the male. The males are very rare and little is known as to the development of the sexual distinctions. In the nymph figured, the form is that of a female, but the hind-wings are as far advanced in development as the tegmina, so that I feel quite uncertain whether this nymph may be of the male or female sex.

N.B. *Phibalosoma novae-britanniae*, Wood-Mason, Ann. Nat. Hist. (4) xx. 1877, p. 75, was not procured by Dr Willey.

[1] Wood-Mason (Ann. Nat. Hist. xx. 1877, p. 75) described *P. novae-britanniae*, but subsequently (J. Asiat. Soc. Bengal, XLVI. pt 2, p. 351) considered this Insect to be *P. feejeeanum* Westw.

EXPLANATION OF PLATES VII—IX.

PLATE VII.

Fig. 1. Myronides filum, male; nat. size.
„ 2. „ binodis, male, metanotum and median segment.
„ 3. „ ramulus, female; nat. size.
„ 4. Brachyrtacus celatus, female; nat. size.
„ 5. Gigantophasma pallipes, male; nat. size.
„ 6. „ bicolor, female; nat. size.
6*a*. Extremity of body, to show outline of cerci and genital operculum.

PLATE VIII.

Fig. 7. Eurycantha horrida, young (probably male). × $\frac{9}{8}$.
7*a*. Antenna more magnified.
„ 8. „ „ young female. × $\frac{13}{12}$.
8*a*. Antenna more magnified.
„ 9. „ „ adult male; nat. size.
„ 10. „ „ adult male, middle of under surface of body; *a*, mesosternum; *b*, *c*, metasternum; *d*, 2nd abdominal sternite of Brunner.
„ 11. Acanthodyta spiniventris, female; nat. size.
„ 12. Cacomorpha aberrans, female; nat. size.
„ 13. Phyllium brachysoma, female; nat. size.
„ 14. Chitoniscus feejeeanus, left tegmen; nat. size.
„ 15. Phyllium sp. young; nat. size.

PLATE IX.

Fig. 16. Anchiale stolli; extremity of body of female, with egg; *a*, superior (of 9th segment), *b*, median (of 9th segment), *c*, inferior (of 8th segment), processes; *d*, egg; *e*, cercus. × $\frac{5}{3}$.
„ 17. Anchiale confusa; extremity of body of female. × $\frac{5}{3}$.
„ 18. Anchiale confusa; dorsal view of terminal segment of male; magnified.
„ 19. „ stolli; „ „ „ „ „ „
„ 20. Acanthodyta spiniventris; extremity of body of male. × 2.
„ 21. Graeffea lifuensis; extremity of body of female. × 2.
„ 22. Gigantophasma pallipes, ♂ hind leg; nat. size.
„ 23. Cacomorpha aberrans; female; side view of middle of body; *a*, pseudo-tracheal gill of metathorax; *b*, base of hind femur. × 4.
„ 24. Phyllium brachysoma, front leg, magnified.

FIG. 25. Anchiale stolli; female nymph, undersurface of extremity of body, to show the partially developed genital processes; 25*a*, the parts in their natural position; *a*, genital operculum formed by 8th segment; *b*, inferior processes (of 8th segment); *c*, superior processes (of 9th segment). 25*b*, the same with the operculum turned forwards; 25*c*, the same with the operculum and inferior processes turned forwards; *d*, median processes (of 9th segment).

„ 26. Myronides sp.? female nymph, to show the partially developed genital processes; 26*a*, the parts in their natural position; 26*b*, with the operculum turned forwards; *a*, operculum; *b*, inferior processes; *c*, superior processes; *d*, median processes.

„ 27. Egg of Anchiale stolli; 27*a*, inferior pole of same, showing hilar scar, *a*. × 8.

„ 28. Hilar area as seen on inner face of endochorion of Anchiale stolli. × 10.

„ 29. Egg of Anchiale confusa; 29*a*, inferior pole of the egg. × 8.

„ 30. Egg-tube of Anchiale confusa with partially formed egg; *a*, the egg proper; *b*, operculum; *c*, capitulum. × 8.

„ 31. Section of operculum and capitulum of egg of Anchiale stolli; *a*, process of the operculum bearing the capitulum *b*. × 8.

„ 32. Egg of Brachyrtacus celatus. × 8.

„ 33. Egg of Myronides bituber; 33*a*, operculum with capitulum, × 8; 33*b*, hilar scar and extremity of hilar area, more magnified.

„ 34. Egg of Myronides sordidus, × 8; 34*a*, operculum and capitulum.

„ 35. Egg of Gigantophasma bicolor. × 8.

„ 36. Egg of Hermarchus pythonius, × 8; 36*a*, operculum.

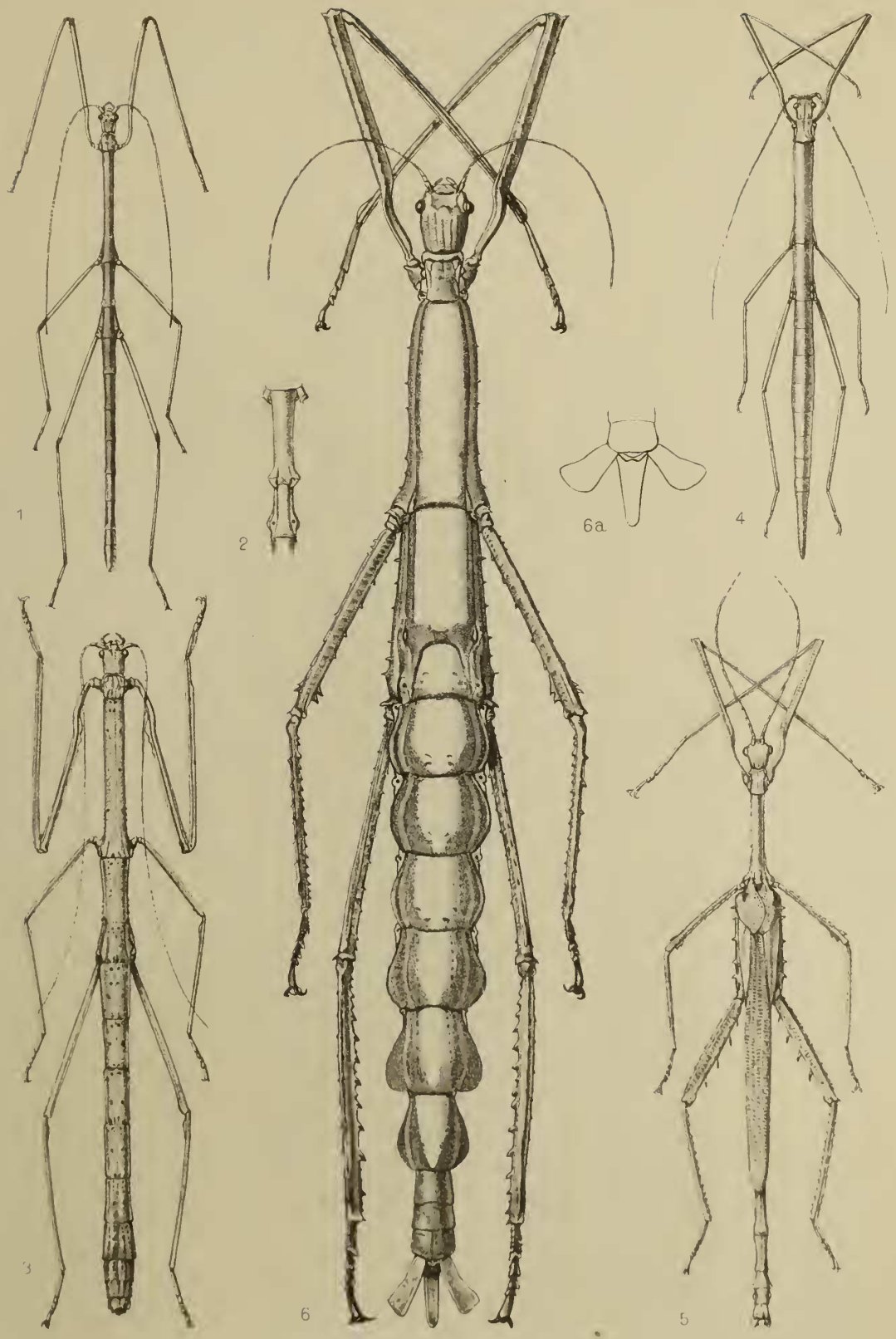
„ 37. Egg-tube of Hermarchus pythonius with young egg; *a*, egg proper; *b*, operculum; *c*, adjacent nutrient chamber. × 8.

„ 38. Part of a young egg of Hermarchus pythonius taken from the egg-tube, showing nutrient matter in the operculum; more magnified.

„ 39. Egg of Cyphocrania hanitschi, × 6; 39*a*, the hilar scar with the true micropylar orifice.

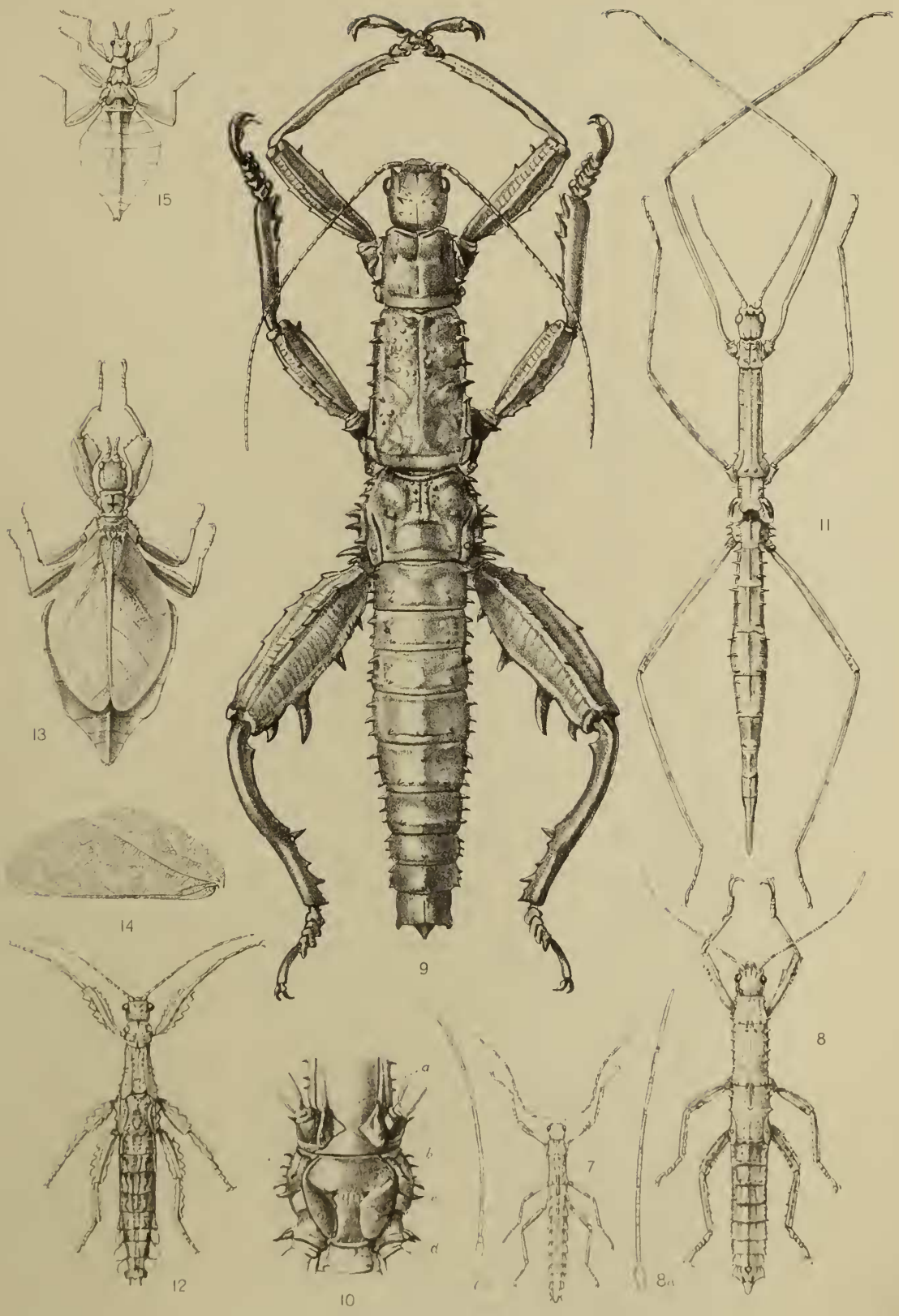
„ 40. Egg of Acanthodyta spiniventris (operculum lost). × 8.

„ 41. Egg of Eurycantha horrida, × 6; 41*a*, operculum detached; 41*b*, central area of operculum.



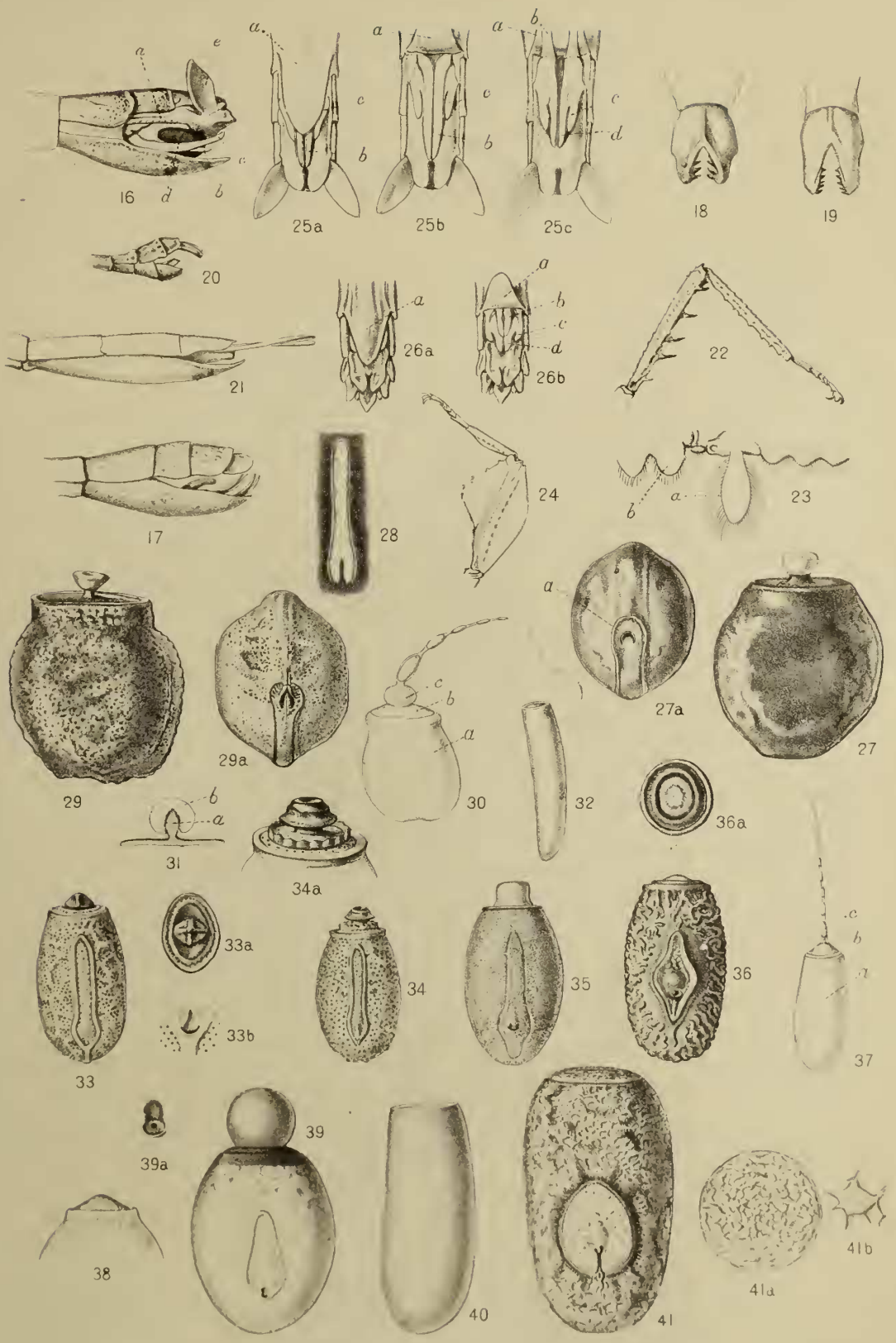
SHAPE PHASMIDAE

Edwin Wilson Cambridge



SHARP PHASMIDAE

Edward Wilson Cambridge



SHARP PHASMIDAE